What is claimed is:

1. A method of making a patterned ceramic film, comprising:

depositing a liquid precursor solution onto a substrate, thereby forming a liquid film, the liquid precursor solution having at least one soluble metal salt dissolved into a photoresist;

patterning the liquid film; and

heating the patterned liquid film, thereby producing the patterned ceramic film;

wherein the patterned ceramic film is adapted for use as at least one of ion-conducting ceramics, electrodes, hard ceramic coatings, transparent conducting oxides, transparent semiconducting oxides, ferroelectric oxides, and dielectric oxides.

2. The method as defined in claim 1 wherein the at least one soluble metal salt includes a metal cation and a salt anion, and wherein the salt anion comprises at least one of nitrates, sulfates, chlorides, and mixtures thereof.

3. The method as defined in claim 2 wherein the at least one soluble metal salt is at least one of cerium nitrate and samarium nitrate.

4. The method as defined in claim 1 wherein the at least one soluble metal salt is substantially completely dissolved into the photoresist, wherein the liquid precursor solution is substantially fully miscible.

5. The method as defined in claim 1 wherein at least one additive is mixed into the liquid precursor solution.

6. The method as defined in claim 5 wherein the at least one additive is at least one of 2,5 dimethyl 2,5-di-t-butylperoxy hexane and alpha, alpha-dimethoxy-alpha-phenylacetophenone.

7. The method as defined in claim 1 wherein the photoresist is at least one of diacrylates, polyvinylphenol (PVP), poly(4-vinylphenol), poly(4-hydroxystyrene), DNQ (diazonaphthoquinone)-Novolaks, and mixtures thereof.

8. The method as defined in claim 1 wherein the liquid film ranges in thickness between about 0.05 μm and about 0.5 μm.

9. The method as defined in claim 1 wherein the patterned ceramic film has a thickness ranging between about 0.2 μm and about 0.3 μm.

10. The method as defined in claim 1 wherein patterning comprises:

masking a predetermined portion of the liquid film, wherein the liquid film has a masked portion and an unmasked portion;

exposing the liquid film to a light source, whereby one of the masked portion and the unmasked portion is cured; and

removing the uncured portion.

11. The method as defined in claim 10, further comprising baking the exposed liquid film before removing the uncured portion.

12. The method as defined in claim 11 wherein the bake temperature ranges between about 50°C and about 250°C.

13. The method as defined in claim 12 wherein the bake temperature is about 100°C.

14. The method as defined in claim 10 wherein the removing is accomplished by solvent stripping.

15. The method as defined in claim 14 wherein the removing is accomplished by dissolving the uncured portion of the liquid film in isopropyl alcohol.

16. The method as defined in claim 1 wherein heating is accomplished by firing the patterned liquid film.

17. The method as defined in claim 16 wherein firing temperatures range between about 540°C and about 1050°C.

18. The method as defined in claim 16 wherein firing temperatures range between about 550°C and about 600°C.

19. The method as defined in claim 1 wherein the substrate is at least one of silicon, single crystal silicon, polycrystalline silicon, silicon oxide containing dielectric substrates, alumina, sapphire, ceramic, and mixtures thereof.

20. The method as defined in claim 1 wherein the depositing is accomplished by one of spin coating, screen printing, dip coating, meniscus coating, and spray coating.

21. The method as defined in claim 1 wherein the patterned ceramic film has a line width, the line width ranging between about 0.5 μm to about 2 mm.

22. A patterned ceramic film produced by the process of claim 1.

23. A fuel cell, comprising:
at least one electrode operatively disposed in the fuel cell; and
an electrolyte in electrochemical contact with the at least one electrode;

wherein at least one of the electrode and the electrolyte comprises a patterned ceramic film produced by the process comprising:

depositing a liquid precursor solution onto a substrate, thereby forming a liquid film, the liquid precursor solution having at least one soluble metal salt dissolved into a photoresist;

patterning the liquid film; and

heating the patterned liquid film, thereby producing the patterned ceramic film.

24. The fuel cell as defined in claim 23 wherein the at least one soluble metal salt is at least one of cerium nitrate and samarium nitrate.

25. The fuel cell as defined in claim 23 wherein the at least one soluble metal salt is substantially completely dissolved into the photoresist, wherein the liquid precursor solution is substantially fully miscible.

26. The fuel cell as defined in claim 23 wherein at least one additive is mixed into the liquid precursor before the liquid precursor is deposited on the substrate.

27. The fuel cell as defined in claim 26 wherein the additive is at least one 2,5 dimethyl 2,5-di-t-butylperoxy hexane and alpha, alpha-dimethoxy-alpha-phenylacetophenone.

28. The fuel cell as defined in claim 23 wherein the electrode is at least one of an anode and a cathode.

29. The fuel cell as defined in claim 23 wherein the photoresist is tetraethylene glycol diacrylate.

30. The fuel cell as defined in claim 23 wherein the patterned ceramic film ranges in thickness between about 0.2 μm and about 0.3 μm.

31. The fuel cell as defined in claim 23 wherein the liquid film ranges in thickness between about 0.05 μm and about 0.5 μm.

32. The fuel cell as defined in claim 23 wherein patterning comprises:

masking a predetermined portion of the liquid film, wherein the liquid film has a masked portion and an unmasked portion;

exposing the liquid film to a light source, whereby one of the masked portion and the unmasked portion is cured; and

removing the uncured portion.

33. The fuel cell as defined in claim 32, further comprising baking the exposed liquid film before removing the uncured portion.

34. The fuel cell as defined in claim 33 wherein the bake temperature ranges between about 50°C and about 250°C.

35. The fuel cell as defined in claim 34 wherein the bake temperature is about 100°C.

36. The fuel cell as defined in claim 32 wherein the removing is accomplished by solvent stripping.

37. The fuel cell as defined in claim 36 wherein the removing is accomplished by dissolving the uncured portion of the liquid film in isopropyl alcohol.

38. The fuel cell as defined in claim 23 wherein the heating is accomplished by firing the patterned liquid film.

39. The fuel cell as defined in claim 38 wherein firing temperatures range between about 540°C to about 1050°C.

40. The fuel cell as defined in claim 23 wherein the substrate is at least one of silicon, single crystal silicon, polycrystalline silicon, silicon oxide containing dielectric substrates, alumina, sapphire, ceramic, and mixtures thereof.

41. An electronic device, comprising:

a load; and

the fuel cell of claim 23 connected to the load.

42. A method of using a patterned ceramic film, the patterned ceramic film having been formed by a process comprising:

depositing a liquid precursor solution onto a substrate, thereby forming a liquid film, the liquid precursor solution having at least one soluble metal salt dissolved into a photoresist;

patterning the liquid film; and

heating the patterned liquid film, thereby producing the patterned ceramic film;

wherein the method of using the patterned ceramic film comprises operatively disposing the patterned ceramic film in a device, wherein the patterned ceramic film comprises at least one of an ion-conducting ceramic, an electrode, a hard ceramic coating, a transparent conducting oxide, a transparent semiconducting oxide, a ferroelectric oxide, and a dielectric oxide.

43. A method of using a fuel cell, comprising:

operatively connecting the fuel cell to a load, wherein the fuel cell comprises at least one of an electrode and an electrolyte comprising a patterned ceramic film formed by a process comprising:

depositing a liquid precursor solution onto a substrate, thereby forming a liquid film, the liquid precursor solution having at least one soluble metal salt dissolved into a photoresist;

patterning the liquid film; and

heating the patterned liquid film, thereby producing the patterned ceramic film.

44. The method as defined in claim 43 wherein the electrode is at least one of an anode and a cathode.

45. A ceramic film, comprising:

a metal-organic liquid precursor solution having a pattern; and

means for converting the precursor solution into the ceramic film having the pattern therein, wherein the ceramic film is adapted for use as at least one of ion-conducting ceramics, electrodes, hard ceramic coatings, transparent conducting oxides, transparent semiconducting oxides, ferroelectric oxides, and dielectric oxides.

46. A method of making a patterned ceramic film, comprising:

depositing a liquid precursor solution onto a substrate, thereby forming a liquid film, the liquid precursor solution having at least one soluble metal salt dissolved into a photoresist, wherein the at least one soluble metal salt is substantially completely dissolved into the photoresist, and wherein the liquid precursor solution is substantially fully miscible;

patterning the liquid film, wherein patterning comprises:

masking a predetermined portion of the liquid film, wherein the liquid film has a masked portion and an unmasked portion;

exposing the liquid film to a light source, whereby one of the masked portion and the unmasked portion is cured; and

removing the uncured portion; and

firing the patterned liquid film at a temperature sufficient to substantially drive off organic materials, thereby rendering the patterned ceramic film;

wherein the patterned ceramic film is adapted for use as at least one of ion-conducting ceramics, electrodes, hard ceramic coatings, transparent conducting oxides, transparent semiconducting oxides, ferroelectric oxides, and dielectric oxides.

47. The method as defined in claim 46 wherein the at least one soluble metal salt is at least one of cerium nitrate and samarium nitrate.

48. The method as defined in claim 46 wherein the liquid film ranges in thickness between about 0.05 μm and about 0.5 μm.

49. The method as defined in claim 46 wherein the patterned ceramic film has a thickness ranging between about 0.2 μm and about 0.3 μm.